

USDA-Agricultural Research Service Fresh and Fresh-Cut Produce Food Safety Research

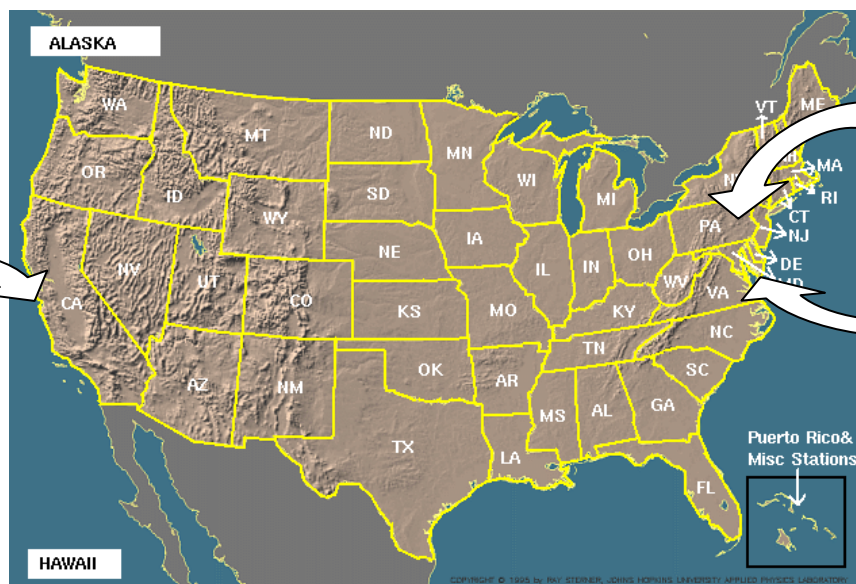
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National Program Leader Food Safety
USDA-ARS National Program Staff**



Produce Food Safety Research Sites



**WRRRC Albany, and
Riverside*, CA**



ERRC Wyndmoor, PA



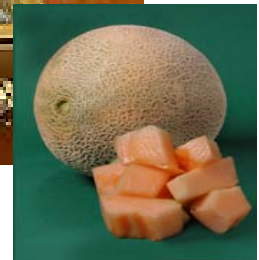
BARC Beltsville, MD

Eastern Regional Research Center

- *Intervention Technologies for Enhancing the Safety and Security of Fresh and Minimally Processed Produce and Solid Plant-Derived Foods (Food Safety Interventions Technology).*
- **Dr. Niemira (215-233-3784; niemira@arserrc.gov)**
- **Goal: Develop new or improved intervention technologies for eliminating or significantly reducing contamination by human pathogens while maintaining quality of fresh and minimally processed produce and solid plant-derived foods.**

Interventions to Control Pathogens.

- Heat
- GRAS compounds such as nisin or organic acids
- Chlorine dioxide gas, gaseous ozone with peroxyacetic acid
- Low dose irradiation alone or in combination
- Vacuum Steam Vacuum (VSV)
- Ultrasound
- Competitive Exclusion/Biofilms
- Packaging materials



BSL-2 Containment Chamber

- **Validation processes: test interventions for produce inoculated with actual pathogens and using industrial scale processing equipment.**

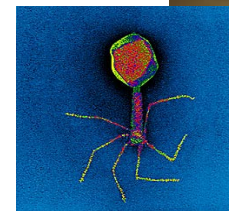
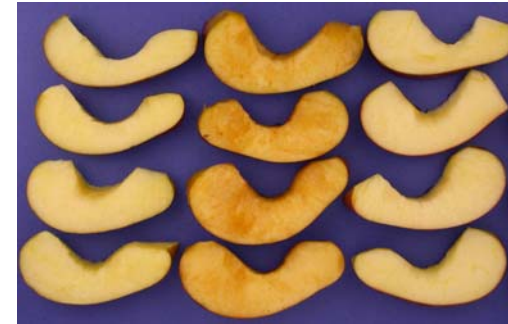


Beltsville Agricultural Research Center

- *Microbial Food Safety of Fresh and Fresh Cut Produce (Produce Quality Safety Lab).*
- **Dr. Bhagwat (301-504-5106; bhagwata@ba.ars.usda.gov)**
- **Goal: Develop comprehensive postharvest systems for eliminating or controlling the growth of human pathogenic microorganisms while maintaining the quality and shelf-life of fresh and fresh-cut produce.**

Interventions to Control Pathogens

- **Acidified Sodium Chloride (ASC):** as an alternative to chlorine
- **PQSL-2** as an alternative to NatureSeal (Ca-Ascorbate)
- **Packaging for fresh-cut:** (MAP) inside high tech packaging films that permits fresh-cut produce to stay fresh for extended periods.
- **Bacteriophage**, or bacteriophage in combination with *Gluconobacter asaii*



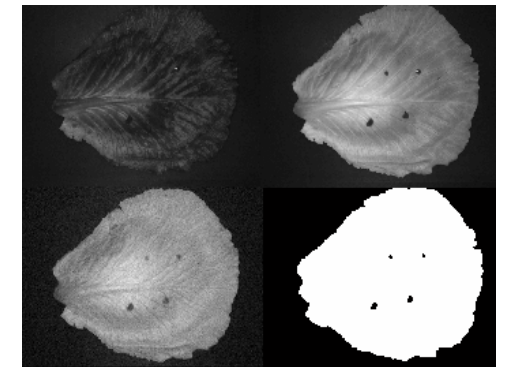
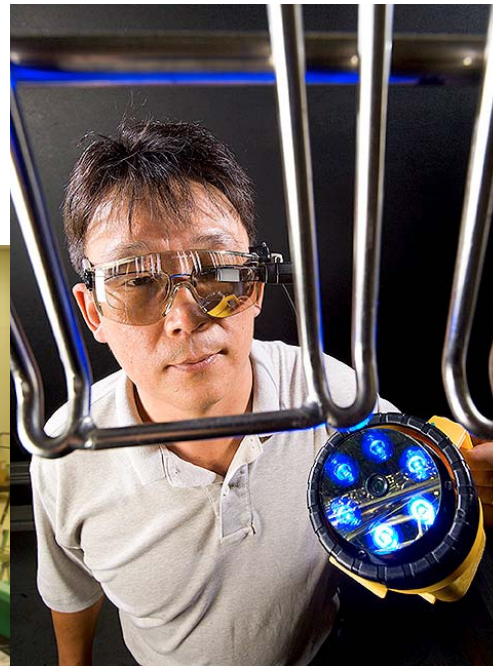
PQSL-BARC

Beltsville Agricultural Research Center (Formation of a new Food Safety Unit)

- *Development of New and Improved Systems to Enhance Food Safety Inspection and Sanitation of Food Processing*
Dr. Kim (301-504-8450; kimm@ba.ars.usda.gov)
- **Goal: To develop automated, accurate, on-line and hand-held computerized sensing which allow for high speed inspection of foods, and sanitation conditions during processing by both, large, small and very small commercial processors.**

Sensor Technologies

Develop imaging systems including portable head-gear for the detection of defects, feces (and perhaps pathogens) on produce: independent of color, size and surface texture



FS-BARC

Beltsville Agricultural Research Center

- ***Microbial Ecology and Safety of Conventional and Organically Grown Produce: Fresh and Fresh-Cut***
Dr. Millner (301-504-8387; millnerp@ba.ars.usda.gov)

Goal: To determine the mechanism (s) and extent to which in-field microbial contamination can occur and persist, both on organic and conventional grown produce.

Beltsville Agricultural Research Center

Objectives:

- **Determine the prevalence, diversity, quantity, colonization, persistence and survival rates of bacteria (E. coli O157:H7) associated with organic/conventional fresh produce.**
- **Examine enteric pathogen transmission by chewing insects.**
- **Investigate the mechanism(s) of introduction and transference of E. coli O157:H7 to lettuce and leafy greens during growing, harvest, postharvest handlings and processing operations.**

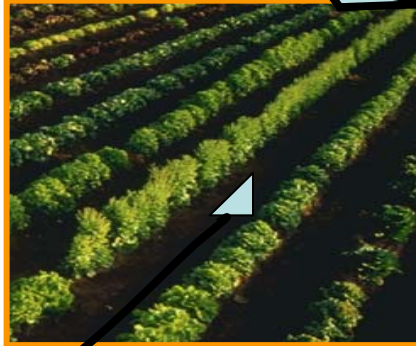
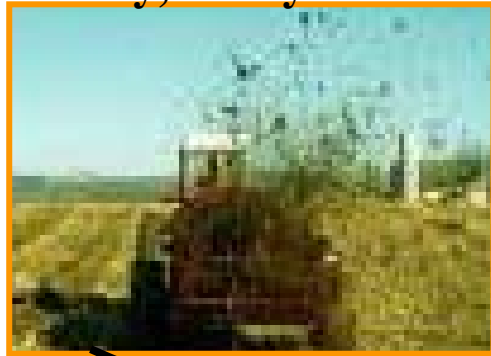


Western Regional Research Center

- *Molecular Microbiology and Control of Enteric pathogens that Contaminate Produce (Produce Safety Microbiology).*
- Dr. Brandl (510-559-5885; mbrandl@pw.usda.gov)
- **Goal: Identify and characterize the bacterial genes involved in attachment, colonization and survival of enteric pathogens on produce; determine the genetic and biochemical factors in plants that affect the attachment, growth and survival of human pathogens in/on plants; identify and characterize the environmental and molecular factors that drive the interaction of enteric pathogens with the resident microflora, and that are conducive to mixed biofilm formation on produce; and develop methods and biosensors for the concentration and detection of enteric viral and bacterial pathogens from produce and soil.**

- Manure, soil
- Dry, windy

AIR



Water/Wildlife

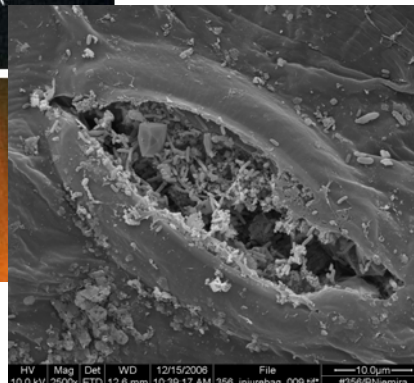
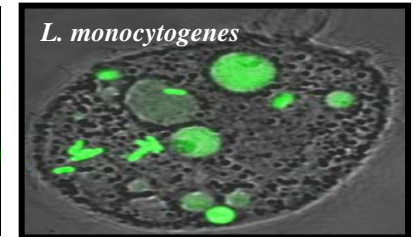
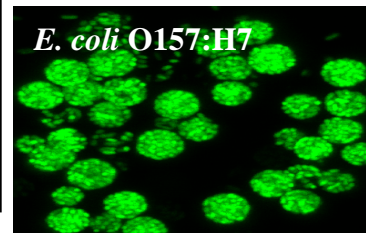
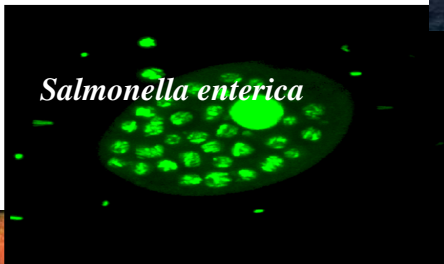
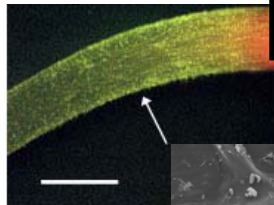
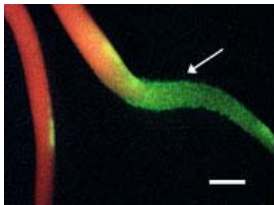


Pathogen Attachment

Salmonella enterica

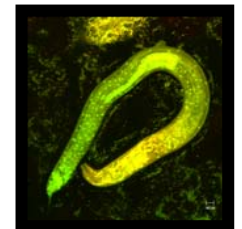
E. coli O157:H7

L. monocytogenes



Protozoa/Nematodes may aid in pathogen transmission

Produce



Slugs: Potential Novel Vectors of Escherichia coli O157. University of Aberdeen. (Ian Ogden): Slugs shed viable *E. coli* in their feces which persisted for up to 3 weeks... we conclude that slugs have the potential to act as novel vectors of *E. coli* O157.

Riverside

- *Detection, Source Identification, Environmental Transport, Fate, and Treatment of Pathogenic Microorganisms Derived from Animal Wastes. (NP206)*
- Dr. Ibekwe (951-369-4828; aibekwe@ussl.ars.usda.gov)

Objectives

- Detection, quantification, and characterization of pathogen behavior in different environmental matrices
- Determine inactivation/survival rates and transport characteristics of fecal coliform and pathogens from manure sources to surface or ground water
- Quantify mechanisms influencing the transport and retention of pathogenic microorganisms in subsurface environments
- Adapt and improve numerical models for simulating the environmental transport and fate of pathogenic microorganisms
- Develop and optimize manure and lagoon water treatment strategies to minimize the transmission of pathogenic microorganisms to food and water resources.

Future Interactions

Draft Prospectus for Interagency Risk Assessment Consortium Work Group: Data Needs for a Quantitative Risk Assessment for Produce.

Deliverables

- **Conceptual model for a farm to table risk assessment for a specific food (e. g, green leafy vegetables) and a specific pathogen (*E. coli* O157).**
- **Initial consideration of how to approach issues related to geographical and seasonal variability.**
- **List of data needs for each component of the conceptual model, including possible intervention/mitigation strategies.**
- **A plan for distributing the list of data needs to individuals, institutions, and organizations with interest in conducting and/or funding food safety research.**
- **Outcome: provide information helpful to many of the IRAC member agencies, including DOD/VMS, EPA/ORD, EPA/OW, FDA/CFSAN, FDA/NCTR, FDA/CVM, USDA/APHIS, USDA/ARS, USDA/CSREES, and USDA/FNS.**

Funding

1998 \$ 5.7M

1999 \$12.5M

2003 \$ 9.5M

2006 \$13.5M

2008 \$14.1M

2009 USDA/REE Produce Food Safety Initiative (\$6.29M)

ARS: \$6.29 M increase but requires similar decrease in funding from within existing base program for a zero net change

CSREES: No increase (realignment within food safety programs)

ERS No increase

NASS No increase